Duane Arnold Energy Center
3277 DAEC Road
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NG-20-0055
10 CFR 140.8
10 CFR 140.11(a)(4)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Duane Arnold Energy Center
Docket No. 50-331
Renewed Op. License No. DPR-49

Request for Exemption from 10 CFR 140.11(a)(4)

Reference: Letter from NEDA (D. Curtland) to USNRC, "Request for Exemption from Portions of 10 CFR 50.47 and 10 CFR Part 50, Appendix E," dated April 2, 2020 (ML20101M779)

Pursuant to 10 CFR 140.8, NextEra Energy Duane Arnold, LLC (NEDA) requests exemption from 10 CFR 140.11(a)(4) for the licensed owners of the Duane Arnold Energy Center (DAEC). 10 CFR 140.11(a)(4) requires licensees to have and maintain two levels of financial protection against off-site liability for each nuclear reactor which is licensed to operate, designed for the production of electrical energy, and has a rated capacity of 100,000 kilowatts electric (KWe) or more. The two levels of financial protections are as follows:

- Primary insurance coverage of $450,000,000 from private sources; and,
- Secondary financial protection in the form of private liability insurance coverage under an industry retrospective rating plan.

NEDA is requesting an exemption to 10 CFR 140.11(a)(4) to reduce the DAEC required level of primary off-site liability insurance to $100 million and eliminate the requirement for DAEC to carry secondary financial protection.

By letter dated March 2, 2020 (ML20062E489), pursuant to 10 CFR 50.82(a)(1)(i), NEDA submitted a certification to the NRC indicating its intention to permanently cease power operations at DAEC on October 30, 2020. After the certifications of permanent cessation of power operation and of permanent removal of fuel from the reactor vessel are docketed for DAEC, in accordance with 10 CFR 50.82(a)(1)(i) and (ii), and pursuant to 10 CFR 50.82(a)(2), the 10 CFR 50 license will no longer authorize reactor operation or emplacement or retention of fuel in the reactor vessel. Consequently, no additional fission products will be generated from the plant after shutdown and the decay heat load on the spent fuel will continue to decline. The proposed exemption would allow a reduction in onsite insurance coverage to a level that is commensurate with the future of the facility and the underlying purpose of the rule.

The underlying purpose of 10 CFR 140.11(a)(4) is to require sufficient liability insurance to ensure adequate funding of any claims resulting from a potential nuclear incident or precautionary evacuation associated with an individual power reactor. However, the regulation does not take into consideration the reduced potential for, and consequences of, such nuclear incidents at permanently shut down facilities. The DAEC facility is a single reactor site and the reactor will be permanently shut down on October 30, 2020 and permanently defueled shortly thereafter. The proposed exemption would allow a reduction of financial protection against off-site liability at DAEC to a level that is commensurate with the permanently defueled status of the facility and the underlying purpose of the rule.

NEDA evaluated the effects of an accident where the spent fuel assemblies in the Spent Fuel Pool (SFP) are uncovered following a drain down event. The analysis submitted in the Referenced letter demonstrates that 10 months after permanent cessation of power operations, there is sufficient time to mitigate events that could lead to a zirconium fire. In the permanently defueled condition, the number and severity of potential radiological accidents is significantly less than when the facility is operating. This reduction in risk supports the basis for the request for the exemption provided in the enclosure to this letter.

NEDA requests review and approval of this exemption request by July 1, 2021 with an effective date no less than 10 months after shutdown.

If you have questions regarding this submittal, please contact J. Michael Davis, Licensing Manager at 319-851-7032.

PHansen for

Dean Curtland
Site Director, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure: Request for Exemption from 10 CFR 140.11(a)(4)

cc: NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
A. Leek, State of Iowa

I Summary Description

Pursuant to 10 CFR 140.8, NextEra Energy Duane Arnold, LLC (NEDA) requests exemption from 10 CFR 140.11(a)(4) for the Duane Arnold Energy Center (DAEC) on behalf of each of the licensed owners of the DAEC. 10 CFR 140.11(a)(4) requires licensees to have and maintain two levels of financial protection against off-site liability for each nuclear reactor which is licensed to operate, designed for the production of electrical energy, and has a rated capacity of 100,000 kilowatts electric (KWe) or more. The two levels of financial protections are as follows:

- Primary insurance coverage of $450,000,000 from private sources; and,
- Secondary financial protection in the form of private liability insurance coverage under an industry retrospective rating plan.

NEDA is requesting an exemption from 10 CFR 140.11(a)(4) to reduce the DAEC required level of primary off-site liability insurance to $100 million and eliminate the requirement for DAEC to carry secondary financial protection.

II Background

DAEC is located near the town of Palo, Iowa in Linn County, and consists of approximately 500 acres adjacent to the Cedar River. DAEC is a boiling water reactor with a rated thermal power of 1912 MWt. A detailed description of the plant is given in the DAEC Updated Final Safety Analysis Report (UFSAR). An Independent Spent Fuel Storage Installation (ISFSI) is situated on the owner controlled area. A detailed description of the ISFSI is found in the "Updated Final Safety Analysis Report for the Standardized Nuhoms® Horizontal Modular Storage System for Irradiated Nuclear Fuel."

By letter dated March 2, 2020 (Reference 1), pursuant to 10 CFR 50.82(a)(1)(i), NEDA submitted a certification to the NRC indicating its intention to permanently cease power operations at DAEC on October 30, 2020. Once fuel has been permanently removed from the reactor vessel, NEDA will submit a written certification to the NRC, in accordance with 10 CFR 50.82(a)(1)(ii) that meets the requirements of 10 CFR 50.4(b)(9). Upon docketing of these certifications, the 10 CFR Part 50 license for DAEC will no longer authorize operation of the reactor or emplacement or retention of fuel into the reactor vessel, as specified in 10 CFR 50.82(a)(2).

Chapter 15 of the UFSAR describes the safety analysis aspects of DAEC that were evaluated to demonstrate that the plant could be operated safely and that radiological consequences from postulated accidents do not exceed regulatory requirements. When the reactor is permanently defueled, the SFP and its supporting systems will be dedicated only to spent fuel storage. Irradiated fuel will continue to be stored in the SFP and the ISFSI until it is removed by the Department of Energy. Additionally, the reactor vessel assembly and supporting structures and systems are no longer in operation and have no function related to the safe storage and management of irradiated fuel in the SFP. Consequently, the only UFSAR Chapter 15 design-basis accident scenario that remains credible in the permanently defueled condition, with fuel stored in the SFP, is a fuel handling accident (FHA).

When the reactor is permanently defueled, the SFP and its supporting systems will be modified and dedicated only to spent fuel storage. A SFP cooling and clean-up system is provided to remove decay heat from the spent fuel stored in the SFP and to maintain a specified water temperature, purity, clarity and level.

III Detailed Description

Pursuant to 10 CFR 140.8, NEDA requests exemption from 10 CFR 140.11(a)(4) on behalf of each of the licensed owners of the DAEC. NEDA is requesting an exemption to 10 CFR 140.11(a)(4) to reduce the DAEC required level of primary off-site liability insurance to $100 million and eliminate the requirement for DAEC to carry secondary financial protection.

10 CFR 140.11(a)(4) reads as follows:

> *(a) Each licensee is required to have and maintain financial protection:*
>
> *(4) In an amount equal to the sum of $450,000,000 and the amount available as secondary financial protection (in the form of private liability insurance available under an industry retrospective rating plan providing for deferred premium charges equal to the pro rata share of the aggregate public liability claims and costs, excluding costs payments of which is not authorized by section 170o.(1)(D) of the Act, in excess of that covered by preliminary financial protection) for each nuclear reactor which is licensed to operate and which is designed for the production of electrical energy and has a rated capacity of 100,000 electrical kilowatts or more: Provided, however, that under such a plan for deferred premium charges for each nuclear reactor that is licensed to operate, no more than $131,056,000 with respect to any nuclear incident (plus any surcharge assessed under subsection 170o.(1)(E) of the Act) and no more than $20,496,000 per incident within one calendar year shall be charged. Except that, where a person is authorized to operate a combination of 2 or more nuclear reactors located at a single site, each of which has a rated capacity of 100,000 or more electrical kilowatts but not more than 300,000 electrical kilowatts with a combined rated capacity of not more than 1,300,000 electrical kilowatts, each such combinations of reactors shall be considered to be a single nuclear reactor for the sole purpose of assessing the applicable financial protection required under this section.*

IV Discussion

The underlying purpose of 10 CFR 140.11(a)(4) is to require sufficient liability insurance to ensure adequate funding of any claims resulting from a potential nuclear incident or precautionary evacuation associated with an individual power reactor. The financial protection limits of 10 CFR 140.11 were established to require that licensees maintain sufficient insurance to cover the costs of a nuclear incident at an operating reactor.

This regulation does not take into consideration the reduced potential for, and consequences of, such nuclear incidents at permanently shut down facilities. DAEC is a single reactor site and the reactor will be permanently shut down and defueled. The proposed exemption would allow a reduction in the level of offsite insurance coverage to a level that is commensurate with the planned permanently defueled status of DAEC and the underlying purpose of the rule.

Although the likelihood of an accident at an operating reactor is small, the consequences can be large, in part due to the high temperatures and pressures of the reactor coolant system as well as the inventory of radionuclides. For a permanently shut down and defueled reactor, nuclear accidents involving the reactor and its associated systems, structures and components are no longer possible. Furthermore, reductions in the probability and consequences of non-operating reactor nuclear incidents are substantially reduced because: 1) the decay heat from the spent fuel decreases over time, which reduces the amount of cooling required to prevent the spent fuel from heating up to a temperature that could compromise the ability of the fuel cladding to retain fission products; and 2) the relatively short-lived radionuclides contained in the spent fuel, particularly the volatile components like iodine and noble gasses, decay away; thus reducing the inventory of radioactive materials available for release.

Although the potential for, and consequences of, nuclear accidents decline substantially after a plant permanently defuels its reactor, they are not completely eliminated. There are potential onsite and offsite radiological consequences that could be associated with the onsite storage of the spent fuel in the SFP. In addition, a site with a permanently shut down and defueled reactor may contain an inventory of radioactive liquids, activated reactor components, and contaminated materials. For purposes of modifying the amount of offsite insurance coverage maintained by a permanently shut down and defueled reactor licensee, the potential radiological consequences of these non-operating reactor nuclear incidents are appropriate to consider, despite their very low probability of occurrence.

NRC Proposed Rulemaking

The NRC has generically evaluated the legal, technical, and policy issues regarding the financial protection requirements for large nuclear power plants that have been permanently shut down. The results of these evaluations were summarized in SECY-96-256 (Reference 2) and the NRC staff recommended course of action was approved by the Commission in a Staff Requirements Memo (SRM). These documents established the basis for the NRC exercising its discretionary authority to specify an appropriate level of onsite insurance coverage for permanently shut down nuclear power reactors.

In SECY-97-186 (Reference 3), the NRC staff proposed rulemaking for Commission approval that was consistent with SECY-96-256, Option 2. In SECY-97-186, the NRC staff proposed changes to 10 CFR 50.54(w)(1) and 10 CFR 140.11(a)(4) that would establish appropriate levels of onsite insurance and offsite liability coverage for plants that are permanently shut down and defueled and that meet specified facility configurations during permanent shutdown.

In October 1997, the NRC published a proposed rulemaking to amend regulations governing liability coverage for permanently shut down nuclear plants. The proposed rulemaking established four different configurations for permanently shut down plants that encompassed anticipated spent fuel characteristics and storage modes during the period between permanent shutdown and termination of the license. The rulemaking proposed financial protection requirements for each of the four specified plant configurations, including a configuration where the plant is permanently shut down, the reactor defueled, and the spent fuel stored in the spent fuel pool is not susceptible to a zircaloy cladding failure or gap release caused by an incipient fuel cladding failure if the pool is accidentally drained.

However, the NRC staff rulemaking efforts were suspended prior to issuing the final rule when it was realized that an NRC staff-approved technical basis did not exist for generic decay times after which the zirconium cladding failure concern could be eliminated. The proposed changes to regulations governing onsite insurance coverage were subsequently included in a risk-informed, integrated rulemaking initiative for decommissioning nuclear power plants, which has yet to be acted on. This rulemaking initiative, documented in SECY-00-145 (Reference 4), included onsite insurance coverage requirements based on the proposed decommissioning insurance rulemaking issued in October 1997, as modified to address the public comments received in response to that proposed rulemaking. The modified rulemaking, as incorporated into SECY-00-145, would have allowed the minimum offsite financial protection requirement to be reduced to $100 million and not require secondary insurance once the spent fuel in the SFP is no longer thermal-hydraulically capable of sustaining a zirconium fire, based on a plant-specific analysis.

As discussed in the staff response to a question in SECY-00-145 (see "NRC Staff Responses to NEI White Paper Comments on Improving Decommissioning Regulations," response to Question 3):

"The staff believes that full insurance coverage must be maintained for 5 years or until a licensee can show by analysis that its spent fuel pool is no longer vulnerable to such [a zirconium] fire."

In addition, as discussed in the staff response to a question in SECY-00-145 (see "NRC Staff Responses to NEI White Paper Comments on Improving Decommissioning Regulations," response to Question 4):

"Since the zirconium fire scenario would be possible for up to several years following shutdown, and since the consequences of such a fire could be severe in terms of offsite health consequences, property damage and land contamination, the staff position is that full offsite liability coverage (both primary and secondary levels) must be retained for five years or until analysis has indicated that a zirconium fire is no longer possible. At that point, primary coverage would be reduced from $200 million to $100 million and participation in the secondary retrospective rating pool would no longer be required."

In a memorandum dated August 16, 2002, the NRC Executive Director for Operations provided the NRC Commissioners a status of the regulatory exemptions for plants in decommissioning. This memorandum stated:

"In the absence of any anticipated nuclear power plant decommissionings in the near term, the staff believes that there is no immediate need for moving forward with a majority of the decommissioning regulatory improvement work that is currently planned. Specifically, broad scope regulatory improvements for decommissioning nuclear power plants do not appear to be of sufficient priority given a lack of future licensees that would benefit.at this time. Due to other higher priorities, resources are being deferred for decommissioning rulemakings that are not currently in progress or not related to security .... If any plants do unexpectedly shutdown permanently, decommissioning regulatory issues would continue to be addressed through the exemption process in a manner similar to the current practice."

Thus, the proposed rulemaking process changes for decommissioning plants discussed above were stopped in deference to the exemption process that had been used for previous licensees.

In January 2018, NRC issued its "Regulatory Analysis for Regulatory Basis: Regulatory Improvements for Power Reactors Transitioning to Decommissioning" NRC-2015-0070, RIN 3150-AJ59 (Reference 5). In Section 5.8 of this Regulatory Basis document, the NRC staff assessed offsite and onsite financial protection requirements and indemnity agreements and proposed alternatives that include an alternative "FP-2." This alternative would involve rulemaking to reduce the primary financial protection requirement in 10 CFR 140.11(a)(4) to $100 million for a reactor that "is defueled and permanently shut down, and spent fuel in the SFP has decayed and cooled sufficiently that it cannot heat up to clad ignition temperature within 10 hours under adiabatic conditions." In Section 8.2.9 of the Regulatory basis document, the NRC staff has recommended alternative FP-2.

V Technical Evaluation

Accident Analysis Overview

10 CFR 50.82(a)(2) specifies that the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel after docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel in accordance with 10 CFR 50.82(a)(1). Following the termination of reactor operations at DAEC and the permanent removal of the fuel from the reactor vessel, the postulated accidents involving failure or malfunction of the reactor and supporting structures, systems and components are no longer applicable.

A summary of the postulated radiological accidents analyzed for the permanently shut down and defueled condition is presented below. Current Federal guidance provided in the EPA's, "Protective Action Guides and Planning Guidance for Radiological Incidents, EPA-400/R-17/001," (Reference 6) Section 2.2.4, "PAGs and Nuclear Facilities Emergency Planning Zones (EPZ)," states that the EPZ is based on the maximum distance at which a PAG might be exceeded.

Section 5.0 of ISG-02 (Reference 7) indicates that site-specific analyses should demonstrate that: (1) the radiological consequences of the remaining applicable postulated accidents would not exceed the limits of the EPA PAGs at the Exclusion Area Boundary (EAB); (2) in the event of a beyond design basis event resulting in the partial drain down of the SFP to the point that cooling is not effective, there is at least 10 hours (assuming an adiabatic heat up) from the time that the fuel is no longer being cooled until the hottest fuel assembly reaches 900°C; (3) adequate physical security is in place to assure implementation of security strategies that protect against spent fuel sabotage; and (4) in the unlikely event of a beyond design basis event resulting from a loss of all SFP cooling, there is sufficient time to implement pre-planned mitigation measures to provide makeup or spray to the SFP before the onset of zirconium cladding ignition.

NEDA also described the applicable DAEC analyses in the "Request for Exemption from Portions of 10 CFR 50.47 and 10 CFR Part 50, Appendix E," dated April 2, 2020 (Reference 8). Specific analyses are summarized in the following sections.

A. Consequences of Design Basis Events

The postulated design basis accident that will remain applicable to DAEC in its permanently shut down and defueled condition is the FHA in the reactor building where the SFP is located. Analysis based on the FHA was performed to determine the dose to personnel in the Control Room and to the public at the Exclusion Area Boundary (EAB or "Site Boundary") as a function of time after shutdown. The FHA analyzed used the calculated number of fuel pin failures based on a drop of the assembly into the reactor core. Dose consequences for a drop over the reactor core bound the consequences of a drop of an assembly in the SFP due to the shorter drop height equating to fewer fuel pin failures. The analysis used the Alternative Source Term methodology from Regulatory Guide 1.183, and concluded that the dose at the EAB 19 days after shutdown (with open containment) is less than 1 rem TEDE, which is below the EPA PAG threshold of 1 rem for recommended evacuation.

B. Consequences of a Beyond Design Basis Event

NEDA performed an analysis, submitted as Attachment 2 to Reference 8, which compares the conditions for the hottest fuel assembly stored in the DAEC fuel pool to a criterion proposed in SECY-99-168 (Reference 9) applicable to offsite emergency response for a unit in the decommissioning process. This criterion considers the time for the hottest assembly to heat up from 30 degrees Celsius (°C) to 900°C adiabatically.

Based on the limiting fuel assembly for decay heat and adiabatic heatup analysis, at 10 months after shutdown (10 months of decay time), the time for the hottest fuel assembly to reach 900°C is >10 hours after the assemblies have been uncovered. As stated in NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants" (February 2001) (Reference 10), 900°C is an acceptable temperature to use for assessing onset of fission product release under transient conditions (to establish the critical decay time for determining availability of 10 hours to evacuate) if fuel and cladding oxidation occurs in air.

Because of the length of time it would take for the adiabatic heatup to occur, there is ample time to respond to any partial drain down event that might cause such an occurrence by restoring cooling or makeup, or providing spray. As a result, the likelihood that such a scenario would progress to a zirconium fire is not deemed credible.

C. Consequences of Other Analyzed Events

Spent Fuel Pool Drain Down

The analysis in Attachment 3 of Reference 8 assumes a complete loss of SFP water inventory while in safe storage. A loss of water shielding above the fuel could increase the offsite radiation levels because of the gamma rays streaming up out of the pool being scattered back to a receptor at the site boundary. The offsite radiological impact of a postulated complete loss of SFP water was assessed. It was determined that the gamma radiation dose rate at the EAB would be less than the EPA PAG exposure levels. The extended period required to exceed the integrated PAG limit of 1 rem TEDE would allow sufficient time to develop and implement onsite mitigative actions and provide confidence that additional offsite measures could be taken without planning if efforts to reestablish shielding over the fuel are delayed. The analysis shows that after approximately 9 months (0.75 years) of decay time, the time to exceed the PAG limit of 1 rem TEDE at the EAB following a SFP drain down is approximately 198 days, or about 6.5 months. This value can be compared to the 10 hour time limit for zirconium ignition in ISG-02

mitigative actions will have been taken far in advanced of exceeding 1 rem TEDE at the EAB. Therefore, conditions 10 months following reactor shutdown are bounded.

The dose rate to the Control Room was determined to be <0.03 mrem/hr. There are no acceptance criteria for the Control Room in ISG-02, however the dose rate values are considered reasonably low and meet the Appendix A to 10 CFR Part 50, "General Design Criteria (GDC)," Criterion 19 requirement of not more the 5 rem whole body for the duration of the accident.

Consequences of a Beyond-Design Basis Earthquake

NUREG-1738 (Reference 10) identifies beyond design basis seismic events as the dominant contributor to events that could result in a loss of SFP coolant that uncovers fuel for plants in the Central and Eastern United States. Additionally, NUREG-1738 identifies a zirconium fire resulting from substantial loss-of-water inventory from the SFP, as the only postulated scenario at a decommissioning plant that could result in significant offsite radiological release. The scenarios that lead to this condition have very low frequencies of occurrence (i.e., on the order of one to tens of times in a million years) and are considered beyond design basis events because the SFP and attached systems are designed to prevent a substantial loss of coolant inventory under accident conditions. However, the consequences of such accidents could potentially lead to an offsite radiological dose in excess of the EPA PAGs (Reference 6) at the EAB.

The risk associated with zirconium cladding fire events decreases as the spent fuel ages. As the spent fuel ages, the decay time increases, the decay heat decreases, and the short-lived radionuclides decay away. As the decay time increases, the overall risk of zirconium cladding fire continues to decrease due to two factors: (1) the amount of time available for preventative actions increases, which reduces the probability that the actions would not be successful; and (2) the increased likelihood that the fuel is able to be cooled by air, which decreases the reliance on actions to prevent a zirconium fire. The results of the research conducted for NUREG-1738 and NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor," (September 2014) (Reference 11) suggests that, while other radiological consequences can be extensive, a postulated accident scenario leading to a SFP zirconium fire, where the fuel has had significant decay time, will have little potential to cause offsite early fatalities due to dose, regardless of the type of offsite response.

The purpose of NUREG-2161 (Reference 11) was to determine if accelerated transfer of older, colder spent fuel from the SFP at a reference plant to dry cask storage significantly reduces the risks to public health and safety. The study states that "this study's results are consistent with earlier research studies' conclusions that spent fuel pools are robust structures that are likely to withstand severe earthquakes without leaking cooling water." The study also shows that, in the event of a radiological release, public and environmental effects are generally the same or smaller than earlier studies.

In SECY-93-127 (Reference 12), the NRC staff considered potential financial liability of a zirconium fire to determine that the overall risk at decommissioning plants does not justify the full insurance coverage once the spent fuel has sufficiently decayed. In its Staff Requirements Memorandum for SECY-93-127 (Reference 13), the Commission approved a policy that authorized reductions in commercial liability insurance coverage through the exemption process

after the spent fuel had undergone an appropriate period of cooling, which the NRC staff defined as when the spent fuel could be air-cooled if the spent fuel pool was drained of water.

In NUREG/CR-6451 "A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants" (Reference 14) the representative BWR was shown to be able to air cool the fuel within a 7-month window. NEDA has compiled data comparing the input parameters between this representative generic analysis and like data for the DAEC. This information is provided in Table 1.

The review of the data shows that the spent fuel pool and nuclear fuel configurations both have an increased capability to remove heat from the fuel. With respect to the heat removal capability of the spent fuel pool, several points of margin compared to the Model Plant include: a 52% reduction in freshly discharged bundles, the spent fuel pool is 75% full versus 100 % full, resulting in additional air flow and cooling pathways, and the newly discharged fuel is a 10×10 array with partial rods and large water rods resulting in a >25% increase in fuel clad surface area and air flow channels within the fuel. With respect to the fuel, the max assembly burn-up and power density are higher, however, these are offset by the 3-month additional source term decay time (10 months versus 7 months) and the increased surface area/ heat transfer area of the 10×10 fuel.

Based on the margins found in the increased heat removal capabilities of the spent fuel pool racks, the additional heat removal capabilities of the nuclear fuel geometry, and the 3 month additional decay beyond the 7 month source decay required for the model plant, it is concluded that reasonable assurance exists that the Duane Arnold spent fuel pool conditions are bounded by the NUREG/CR-6451 analysis, demonstrating that the Duane Arnold Spent fuel can be air cooled following 10 months of source term decay.

Table 1 – NUREG/CR-6451 Spent Fuel Zirconium Fire Comparison

Item	Parameter	NUREG/CR-6451 Model Plant Value	DAEC Value (Reference)	Difference
1	Plant Data a) Power b) Assemblies c) MWt/Assembly	 a) 3300 MWt b) 764 c) 4.3	 a) 1912-MWt (UFSAR Sect. 1.1) b) 368 (UFSAR, Sect. 1.2.5.1.1) c) 5.2 (Calculated)	 396 fewer newly discharged assemblies which reduces the overall heat load in the pool
2	Spent Fuel Pool Storage Data a) Total Capacity b) Quantity in SFP	Assemblies a) 3300 b) 3300	Assemblies a) 2411 (UFSAR, Sect. 9.1.2.2.1) b) 1818 (Physical Inventory)	DAEC fuel pool is only 75% full increasing the quantity of air flow passages to allow for fuel and fuel pool rack cooling
3	SFP Rack Design a) Design b) Material c) Pitch d) Orifice Size	 a) High Density b) Stainless Steel c) 6.255" d) 4"	 a) High Density (UFSAR, Sect. 9.1.2.2.2) b) Stainless Steel (Holtec) c) 6.06" Holtec Rack (Holtec dwg M453-012) d) 3.625" Holtec (Holtec dwg M453-003) The 368 bundles removed from the reactor in November 2020 will be inserted into the HOLTEC racks in the SFP.	 Orifice: Bounded by maximum fuel orifice size = 3.505" (Fuel Bundle Drawings)
4	Fuel Max Assembly Burnup	40 GWD/MTU	50.4 GWD/MTU (Calculated)	Potentially up to 27% higher heat due to increased max assembly burnup
5	Source Term Decay	7 Months	10 Months (Reference 8)	15% less decay heat contribution from hot bundles due to longer source term decay time
6	Zirconium Oxidation Temperature Limit	565° C	565° C	Same
7	Fuel Design	7x7 bundle design	10x10 bundle design (Calculation M19-001)	>25% Increase heat transfer surface area.14 partial rods and 2 large water rods increase air flow pathways

NEDA conducted a seismic evaluation in response to Recommendation 2.1 of the Near Term Task Force (NTTF) review of the accident at the Fukushima Dai-Ichi nuclear facility. This evaluation included the spent fuel pool and was submitted to the NRC for review (Reference 15). This evaluation provides a specific assessment of earthquake probabilities versus ground acceleration for the Duane Arnold Energy Center, and concludes, regardless of response

spectral frequency, the probability is less than 2 x 10^{-6}/year. The NRC review of this evaluation is documented in References 16 and 17.

VI JUSTIFICATION FOR EXEMPTIONS AND SPECIAL CIRCUMSTANCES

10 CFR 140.8 states that the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations in this part which are authorized by law and are otherwise in the public interest. As discussed below, this exemption request satisfies the provisions of Section 10 CFR 140.8.

A. The exemptions are authorized by law

10 CFR 140.8 allows the NRC to grant exemptions from the requirements of 10 CFR Part 140. The proposed exemption would not result in a violation of the Atomic Energy Act of 1954, as amended (Price-Anderson Act), which requires that power reactor licensees maintain some level of public liability financial protection. Exemptions granted to other licensees for insurance reductions of the same regulation being requested here by NEDA have been previously determined to be authorized by law and granted, see Section E below.

Additionally, as discussed in USNRC letter to Dominion Nuclear Connecticut, Inc. (Reference 18), post-shutdown Insurance requirements for decommissioning nuclear power plants were addressed in a letter from the Executive Director for Operations to the Chairman of the Advisory Committee on Reactor Safeguards (ACRS) dated September 17, 2001. The staff and the ACRS agreed that onsite and offsite insurance coverage can be substantially reduced shortly after a facility permanently shuts down. The ACRS also accepted the staff's assessment that the primary insurance level can be reduced to $100 million and that decommissioning licensees be released from participation in the secondary insurance pool. Therefore, the exemption is authorized by law.

B. The exemptions is otherwise in the public interest

Approval of the exemption request would result in more efficient use of funds in the DAEC decommissioning trust fund. The reduction in offsite financial protection from $450 million to $100 million and elimination of the requirement to participate in the secondary insurance pool would continue to require a level of financial protection commensurate with the underlying purpose of the rule while eliminating an unnecessary financial burden. Therefore, the proposed exemption is otherwise in the public interest.

E. Precedent

The exemption request for 10 CFR 140.11(a)(4) is consistent with exemption requests that recently have been issued by the NRC for other nuclear power reactor facilities beginning decommissioning. Specifically, the NRC granted similar exemptions to Entergy Nuclear Operations, Inc., for Vermont Yankee (ML16012A144); to Duke Energy Florida, Inc. for Crystal River Unit 3 (ML14183B338); to Southern California Edison Company for SONGS, Units 1, 2, and 3 (ML17339A125); to Omaha Public Power District for Fort Calhoun Station, Unit 1 (ML18025A402); to Dominion Energy Kewaunee, Inc. for KPS (ML15026A544); and to Entergy Nuclear Operations, Inc., for Pilgrim (ML19282A036). Similar to the current request, these precedents each resulted in exemptions from the requirements in 10 CFR 140.11(a)(4).

VII ENVIRONMENTAL ASSESSMENT

The proposed exemption meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(25), because the proposed exemption involves: (i) no significant hazards consideration; (ii) no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (iii) no significant increase in individual or cumulative public or occupational radiation exposure; (iv) no significant construction impact; (v) no significant increase in the potential for or consequences from radiological accidents; and (vi) the requirements from which the exemption is sought involve surety, insurance or indemnity requirements. Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed exemption.

(i) No Significant Hazards Consideration Determination

NEDA has evaluated the proposed exemption to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92 as discussed below:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

   The proposed exemption has no effect on structures, systems, and components (SSCs) and no effect on the capability of any plant SSC to perform its design function. The proposed exemptions would not increase the likelihood of the malfunction of any plant SSC.

   When the exemption becomes effective, there will be no credible events that would result in doses to the public beyond the Exclusion Area Boundary (EAB) that would exceed the Environmental Protection Agency (EPA) Protective Action Guides (PAGs). The probability of occurrence of previously evaluated accidents is not increased because most previously analyzed accidents will no longer be able to occur and the probability and consequences of the remaining postulated accident, a Fuel Handling Accident, is unaffected by the proposed exemption.

   Therefore, the proposed exemptions do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed exemption create the possibility of a new or different kind of accident from any accident previously evaluated?

   The proposed exemption does not involve a physical alteration of the plant. No new or different type of equipment will be installed and there are no physical modifications to existing equipment associated with the proposed exemptions. Similarly, the proposed exemptions will not physically change any SSCs involved in the mitigation of any accidents. Thus, no new initiators or precursors of a new or different kind of accident are created. Furthermore, the proposed exemption does not create the possibility of a new accident as a result of new failure modes associated with any equipment or personnel failures. No changes are being made to parameters within which the plant is normally operated, or in the setpoints which initiate protective or mitigative actions, and no new failure modes are being introduced.

Therefore, the proposed exemption does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed exemption involve a significant reduction in a margin of safety?

The proposed exemption does not alter the design basis or any safety limits for the plant. The proposed exemptions do not impact station operation or any plant SSC that is relied upon for accident mitigation.

Therefore, the proposed exemptions do not involve a significant reduction in a margin of safety.

Based on the above, NEDA concludes that the proposed exemptions present no significant hazards consideration, and, accordingly, a finding of "no significant hazards consideration" is justified.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

There are no expected changes in the types, characteristics, or quantities of effluents discharged to the environment associated with the proposed exemption. There are no materials or chemicals introduced into the plant that could affect the characteristics or types of effluents released offsite. In addition, the method of operation of waste processing systems will not be affected by the exemption. The proposed exemption will not result in changes to the design basis requirements of SSCs that function to limit or monitor the release of effluents. The SSCs associated with limiting the release of effluents will continue to be able to perform their functions. Therefore, the proposed exemption will result in no significant change to the types or significant increase in the amounts of any effluents that may be released offsite.

(iii) There is no significant increase in individual or cumulative public or occupational radiation exposure.

The proposed exemption does not involve any physical alterations to the plant configuration or any changes to the operation of the facility that could lead to a significant increase in individual or cumulative occupational radiation exposure.

(iv) There is no significant construction impact.

No construction activities are associated with the proposed exemption.

(v) There is no significant increase in the potential for or consequences from radiological accidents.

See the no significant hazards considerations discussion in Item (i)(1) above.

(vi) Surety, insurance or indemnity requirements.

The requirements from which the exemption is sought involve financial protection and for the indemnification and limitation of liability of licensees pursuant to Section 170 of the Atomic Energy Act of 1954, as amended and 10 CFR 140.11(a)(4).

VIII REFERENCES

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2. SECY-96-256, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors," dated December 17, 1996 (ML15062A483)
3. SECY-97-186, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11," dated August 13, 1997 (ML992930019)
4. USNRC, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning," Commission Paper SECY-00-145, June 28, 2000 (ML003721626)
5. NRC-2015-0070, RIN 3150-AJ59, "Regulatory Analysis for Regulatory Basis: Regulatory Improvements for Power Reactors Transitioning to Decommissioning," dated January 2018 (ML17332A075)
6. EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," dated January 2017 (ML17044A073)
7. NSIR/DPR-ISG-02, "Interim Staff Guidance, Emergency Planning Exemption Requests for Decommissioning Nuclear Power Plants," dated May 11, 2015 (ML14106A057)
8. Letter from NEDA (D. Curtland) to USNRC, "Request for Exemption from Portions of 10 CFR 50.47 and 10 CFR 50, Appendix E," NG-19-0142, dated April 2, 2020 (ML20101M779)
9. Commissioning Paper SECY-99-168, "Improving Decommissioning Regulations for Nuclear Power Plants," dated June 30, 1999 (ML992800087)
10. NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," dated February 2001 (ML010430066)
11. NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor," September 2014 (ML14255A365)
12. SECY-93-127, "Financial Protection Required of Licensees of Large Nuclear Power Plants During Decommissioning," dated May 10, 1993 (ML12257A628)
13. Staff Requirements Memorandum for SECY-93-127, dated July 13, 1993 (ML003760936)
14. NUREG/CR-6451 "A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants," dated August 31, 1997 (ML082260098)
15. Letter from NEDA (R. Anderson) to USNRC, "NextEra Energy Duane Arnold, LLC Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," NG-14-0092, dated March 28, 2014 (ML14092A331)
16. Letter from USNRC to NEDA (T. Vehec), "Duane Arnold Energy Center- Staff Assessment of Information Provided Pursuant to Title 10 of the Code of Federal Regulations Part 50, Section 50.54(f), Seismic Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident (TAC No. MF3783)," dated December 15, 2015 (ML15324A176)
17. Letter from USNRC to Listed Power Reactor Licensees, "Staff Review of High Frequency Confirmation Associated with Reevaluated Seismic Hazard in Response to March 12, 2012 50.54(f) Request for Information," dated February 18, 2016, (ML15364A544)
18. Letter, USNRC to Dominion Nuclear Connecticut, Inc., "Millstone Power Station, Unit 1 – Exemption from Certain Requirements of 10 CFR Part 140," dated March 30, 2004 (ML040890981)